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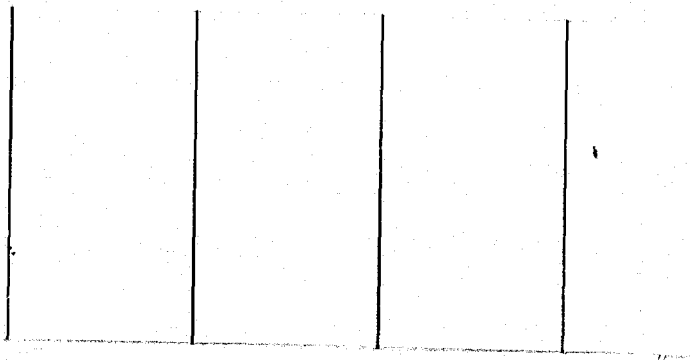

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Retransmission of Hydrometric Data in Canada

SR 28190

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Department of the Environment
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15. Abstract

Data Collection Platforms have been installed at 18 sites in remote areas of Canada for transmittal of water level and other water resource data. The implementation of the Alaska Receive Site in December, 1975 has increased the value of the system substantially. The near real-time data are used for water management purposes. The system has met all requirements and the suitability of satellite retransmission has been demonstrated.

I. Introduction

The Water Survey of Canada operates over 2,400 hydrometric stations at which water level data are collected. Because of the isolated locations of many of these stations, it usually is not economically feasible to telemeter data from the sites by conventional means. For this reason an experiment was conducted which involved transmitting data from nine sites by means of Landsat 1. The technical suitability of the system was demonstrated and in response to a demand for near real-time data from additional sites, it was decided to implement a larger network. In this way, it should be possible to determine the benefits and costs associated with a larger operational system.

II. Techniques

Data Collection Platforms have now been installed at 18 sites including Principal Investigator A.C.D. Terroux, Platform 6210 at the Quebec Department of Natural Resources gauging station on the Rivière Dumoine a la sortie du lac Dumoine, a tributary to the Ottawa River. An additional 11 DCPs will be installed in 1976. The sites (Figure 1, Table 1) were selected on the basis of real time data needs for water management purposes. Water level data are transmitted from all sites while additional parameters, mainly meteorological data, are transmitted from some sites.

Water levels are sensed at Water Survey of Canada gauging stations by a float and pulley or by servomanometer that sense the static pressure in a nitrogen purge system. Water level is usually recorded on a strip chart recorder. At those stations where DCPs are installed, an analogue to digital shaft position encoder (the Stevens Memomark II) is used to encode and store 16 bits (4 BCD digits) of water level data for transmittal by the DCP.

Precipitation data are obtained using a Fisher and Porter weighing type precipitation gauge. The gauge can be equipped with a Telekit for telemetering of data. The gauge is connected to a serial digital interface designed by Atmospheric Environment Service, (AES) Department of the Environment. The interface is known as a Hydrometeorological Automatic Recording and Telemetering System (HARTS). Air temperature in the HARTS system is sensed by a platinum resistance bulb thermometer. A precision thermistor (YSI 44033) is also used in some other cases.

The data transmitted by DCPs are processed by NASA, then sent to Canada in two ways. The first is by land line to the Canada Centre for Remote Sensing in Ottawa. The data usually arrives shortly after each orbit of the spacecraft. At CCRS the

FIGURE I

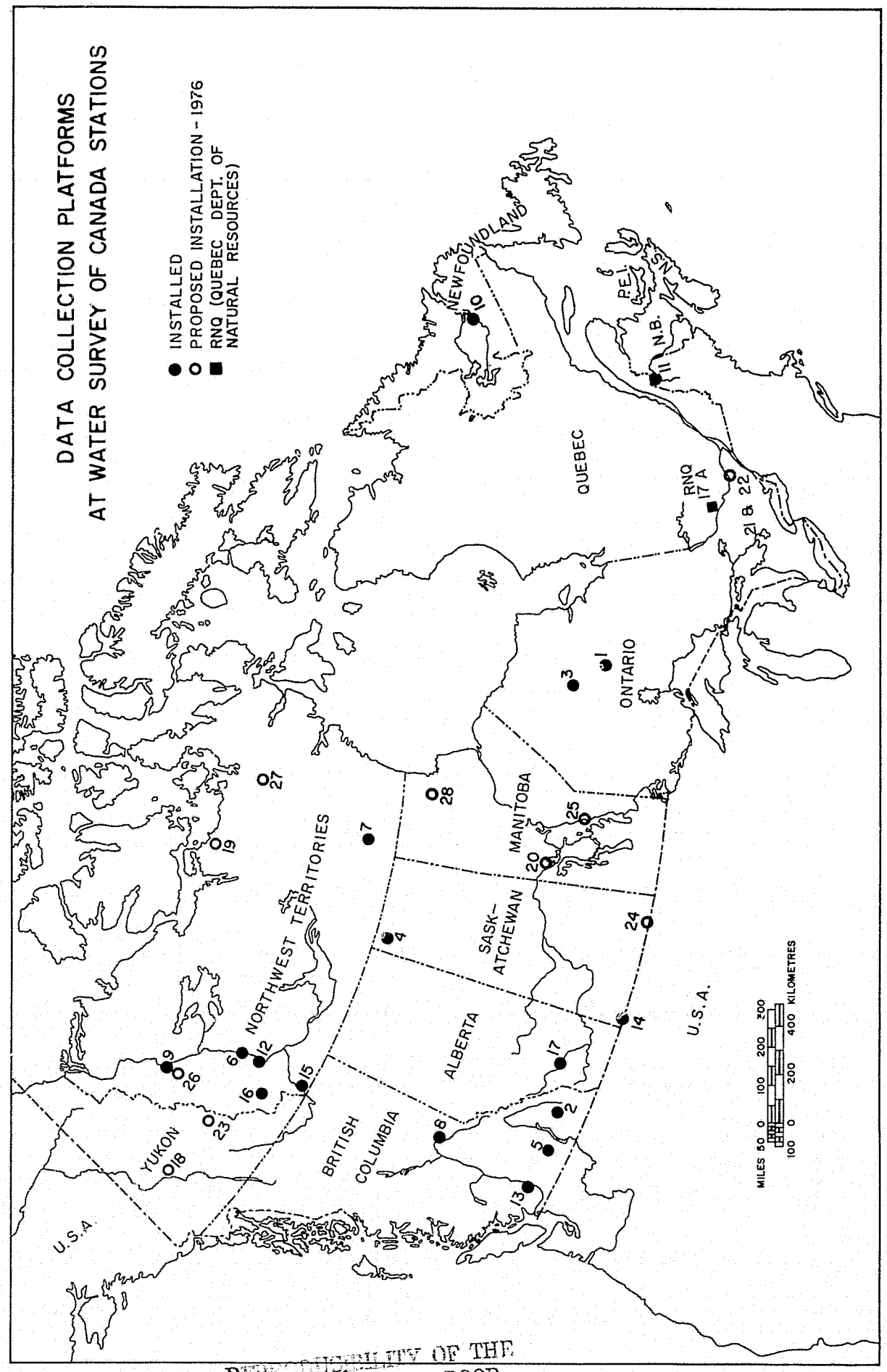

TABLE 1

LOCATION OF DATA COLLECTION PLATFORMS

	INSTALLED AT HYDROMETRIC STATIONS	DATE INSTALLED	DCP	LAT.	LONG.
1)	Albany River above Nottik Island	Jan 13, 73	6102	51° 38'	86° 24'
2)	Carney Creek below Pambrun Creek	Mar 25, 75	6126	50° 10'	116° 35'
3)	Winisk River at Kanuchuan Rapids	Sept 27, 74	6137	52° 58'	87° 42'
4)	Lake Athabasca at Crackingstone Point	Sept 19, 72	6150	59° 23'	108° 53'
5)	Snow course No. 5A Mission Creek	Oct 31, 75	6232	49° 57'	118° 55'
6)	Mackenzie River near Wrigley	June 7, 73	6260	63° 16'	123° 36'
7)	Kazan River at Outlet of Ennadai Lake	Sept 19, 72	6350	61° 16'	100° 58'
8)	McGregor River at Lower Canyon	Mar 9, 76	6501	54° 14'	121° 40'
9)	Mackenzie River at Sans Sault Rapids	May 31, 73	6366	65° 46'	128° 45'
10)	Churchill River at Muskrat Falls	Aug 7, 75	6502	53° 15'	60° 47'
11)	St. Francis River at Outlet of Glacier Lake	Aug 13, 75	6504	47° 12'	68° 57'
12)	Root River near the Mouth	July 15, 75	6512	62° 29'	123° 26'
13)	Nahatlatch River below Tachewana Creek	Oct 20, 75	6514	49° 57'	121° 52'
14)	Battle Creek at International Boundary	Oct 22, 75	6541	49° 00'	109° 25'
15)	Liard River at Fort Liard	July 17, 75	6547	60° 15'	123° 29'
16)	South Nahanni River above Virginia Falls	July 15, 75	6572	61° 38'	125° 48'
17)	Bow River below Carseland Dams	Oct 27, 75	6574	50° 50'	113° 25'
17A	Rivière Dumoine a la sortie du lac Dumoine (RNQ)	Mar 25, 76	6210	46° 49'	77° 52'
	PROPOSED - 1976				
18)	Pelly River at Pelly Crossing		6354	62° 50'	136° 35'
19)	Ellice River near the Mouth		6507	67° 42'	104° 08'
20)	Moose River near Moose Lake		6511	53° 38'	100° 19'
21)	Rideau River at Ottawa Test Site (now in operation in the GOES mode)		6517	45° 23'	75° 42'
22)	Rideau River at Ottawa Test Site (now in operation in the GOES mode)		6521	45° 23'	75° 42'
23)	South MacMillan River at Mile 249 Canal Road		6522	62° 55'	130° 32'
24)	Long Creek at Western Crossing of International Boundary		6524	49° 00'	103° 21'
25)	Lake Winnipeg at Berens River		6527	52° 21'	97° 00'
26)	Mountain River below Cambrian Creek		6542	65° 14'	128° 34'
27)	Back River below Deep Rose Lake		6544	66° 05'	96° 30'
28)	Seal River below Great Island		6571	58° 54'	96° 17'

data are recorded simultaneously on a teletype hard copier and on magnetic tape. A software data retrieval system sorts the user platforms, reformats the data into engineering units and stores individual user files on disk. The user may then access his data file, usually daily, using either a teletype or telex remote terminal.

The second way that data are received from NASA is by punched card and uncalibrated computer listings about two weeks after transmittal by the DCP. These data are delivered to the Canadian Embassy in Washington, D.C., then carried by diplomatic bag to the Department of External Affairs in Ottawa. External Affairs then mails the data to the user. The cards are run in computer programs that sort the data and perform the conversion to engineering units. Data produced in this way are used to generate statistics on DCP performance, for quality checks and for archival purposes.

III. Accomplishments

Platform 6210 was installed at the Quebec Department of Natural Resources gauging station on the Rivière Dumoine a la sortie du lac Dumoine on March 25, 1976. Water level and temperatures using a YSI thermistor are being sensed. These readings will be used in a Streamflow Synthesis and Reservoir Regulation Model (SSARR) of the Ottawa River. This model will be used for water level forecasting and river management particularly during periods of high flows.

Platform 6501 was installed on the McGregor River at Lower Canyon replacing PID 6354 which failed to operate. The cause of failure at this time is not known. The McGregor River is a tributary in the headwaters of the Fraser River. Data from this site is used to prepare Fraser River flood forecasts.

Table 2 is a summary of the data retransmitted for Landsat 2 cycles 19 to 23 covering a period from January 4 to April 2, 1976. During this period about 10,000 messages were processed. The relatively few number of transmissions for cycles 19, 20 and 21 for platforms 6137, 6502, and 6504 are believed to be a function of the cold weather on the efficiency of the power supply. Platform 6137 is powered by Cipel and Le Carbone Type 321 J air-depolarized primary cells. During the winter of 1974-75 the number of transmissions dropped with lower temperatures and ceased at -20°C. During the winter of 1975-76 the same pattern occurred except that the platform ceased transmitting at slightly lower temperatures, probably due to the addition of 3, 1.5 V primary cells to the power supply. It should be noted that the manufacturer

TABLE 2

SUMMARY OF RETRANSMITTED DATA - JANUARY 4 TO APRIL 3, 1975

Daily Mean Transmissions per cycle for cycles 19 to 23 (Landsat-2)
(Transmissions received simultaneously at two or more sites are counted only once.)

Platform	19	20	21	22	23	Daily Max	Daily Min*	Total
6102	7	8	8	7	7	12	1	665
6126	4	5	5	4	4	7	1	394
6137	8	8	13	9	14	20	1	921
6150	25	24	26	26	27	33	11	2,303
6232	12	12	14	14	14	18	5	1,172
6353	27	28	30	28	30	37	12	2,584
6501	-	-	-	2	1	4	1	26
6502	2	7	5	4	9	13	1	214
6504	4	4	7	8	9	13	1	431
6514	6	5	5	7	6	11	1	525
6541	3	4	4	3	4	7	1	321
6574	15	11	-	-	-	18	10	286
								9,842

* The minimum daily number of transmissions do not necessarily reflect the true minimum as the DCP could be turned off for part of the day the minimum value occurred.

warned that the cells would not be able to supply the 3.3 A peak current draw at -40°C. Platforms 6502 and 6504 have a standard 12 volt power supply.

During December, 1975 a receive site was made operative at Fairbanks, Alaska. In order to assess the signifance of the additional station, the number of transmissions received at each receive station for cycle 19 (January 4 to January 21, 1976) was tabulated. Table 3 summarizes the results of the number of messages received for cycle 19. The table clearly indicates the significance of the Fairbanks, Alaska receive site. The column showing the discrete reading counts messages received simultaneously at two receive sites once. A similar table will be prepared during a cycle this summer. At that time more platforms should be in operation to give a better indication of the value of the Alaska receive site.

IV. Significant Results

The project continues to demonstrate the feasibility of transmitting hydrometric data to polar orbiting spacecraft and using these data on a quasi-operational basis.

The implementation of the receive site in Alaska in December, 1975 has a significant impact on the Canadian experiment as the number of transmissions received from some northern and northwestern sites has increased substantially.

V. Publications

None during this report period.

VI. Problems

No serious problems during this report period.

VII. Data Quality and Delivery

Examination of a random sample of about a week of messages revealed that it takes from a few minutes to several hours from the time the messages are transmitted by a DCP to the time the messages are received by dedicated phone line at the Canada Centre for Remote Sensing, Ottawa. Except for possible emergency situations, this time delay does not degrade the usefulness of Landsat. The hard copy in card form arrives 10 to 14 days after the messages have been transmitted. Again this time delay does not degrade the usefulness of Landsat.

TABLE 3

MESSAGES RECEIVED FROM LANDSAT-2 DURING CYCLE 19 (JANUARY 4 TO JANUARY 21, 1976)

PID	Messages					Orbits				
	Received at			Total	Discrete	Messages Received at			Total	Discrete
	A	G	N			A	G	N		
6102	4	23	118	145	131	4	20	63	87	74
6126	33	65	7	105	66	31	48	7	86	51
6137*	23	50	89	162	131	21	36	51	108	78
6150	269	139	116	524	439	140	62	60	262	174
6232	102	147	38	287	212	70	60	28	158	98
6353	301	139	144	584	489	132	62	68	262	175
6502*	0	0	6	6	6	0	0	4	4	4
6504*	0	0	12	12	12	0	0	12	12	12
6514	61	98	4	163	106	46	52	4	102	59
6541	15	59	12	86	63	15	41	11	67	46
6574	132	146	79	357	277	80	61	43	184	113

* - Partial cycle

A - Fairbanks, Alaska

G - Goldstone, California

N - Greenbelt, Maryland

VIII. Recommendations

None at this time.

IX. Conclusions

Results to this time have demonstrated the suitability of satellite retransmissions as a means of obtaining near real-time data from remote areas in Canada. Capital costs of the equipment installed at a gauging station are reasonable and the indications are that the DCPs do not require much maintenance.

The potential impact of this technology on water resources data gathering activities is considerable. More work with quasi-operational programs is needed to determine the precise benefits.